HALEAKALA NATIONAL PARK CRATER DISTRICT RESOURCES BASIC INVENTORY: INSECTS AND OTHER TERRESTRIAL ARTHROPODS[1]

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During the past three summers (1975-77) RBI collections of insects and other terrestrial arthropods were made at numerous sites within Haleakala National Park, primarily along established RBI transects. The most intensive collecting was done in the relatively dry higher elevation areas of the Park above 1800 m, within the crater and on the western rim between Hosmer Grove and the summit, and in Kaupo Gap at 1500 m elevation and above. These collections contain approximately 20,000 specimens, most of which have been mounted and labeled for study. Much of the material has been identified by the authors and collaborators, and a preliminary checklist has been prepared. The ultimate objective of this study is to produce, in as complete a form as possible, a checklist of the terrestrial arthropods of Haleakala National Park, annotated with data on host relationships, distribution, and other pertinent ecological information. However, several important major taxa are as yet either unstudied or only partly identified, and it is anticipated that the checklist will require several years for completion.

On the basis of material which has been identified to date, we estimate that our Haleakala collections contain well over 400 species of insects and other arthropods, of which approximately 250 species are Hawaiian Island endemics (greater than 60% of the total fauna), and at least 50 species are known only from Haleakala. The collections contain a substantial number of undescribed endemic insects, several of which had not been collected previously (e.g., a new flower-infesting tephritid fly associated with the Maui wormwood, Artemesia mauiensis). On the other hand, several endemic species previously described from Haleakala are not represented in our material.

We estimate that our collections contain around 70-80% of the terrestrial arthropod species which occur in the highlands of

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Haleakala. However, the wetter environments found within the Park are relatively poorly represented in our material. Collections from Paliku and vicinity contain a number of rain forest associated elements which were not taken elsewhere within the Park, but the Paliku fauna appears to be a relatively depauperate segment of the richer wet forest insect faunas which occur outside the Park boundaries, and, probably, within the Kipahulu extension. Should collections from the Kipahulu area become available for study, we anticipate that the present checklist would have to be greatly expanded.

Collecting Methods and Results

The beating net proved to be the most productive tool for sampling the insect faunas associated with various species of shrubs and small trees which dominate the flora of the higher elevation ecosystems of Haleakala. Hand picking, while sorting through leaf litter and bunch grasses, and searching beneath loose stones were most effective for sampling the litter and soil associated forms, many of which are flightless. Pitfall traps proved useful in some situations for sampling nocturnally active ground dwellers such as carabid beetles. Aerial nets were used to some extent to sample diurnal flying insects such as the Odonata, Diptera, Aculeate Hymenoptera, and diurnal Lepidoptera. A malaise trap proved to be productive of flying forms in some areas where suitable sites for erection of the trap were available. A battery-powered ultraviolet light trap was operated at a number of sites, both within the crater and on the west rim, with generally good results. The light trap yielded primarily noctuid moths, both endemic and introduced species, frequently in large numbers. In comparison to similar traps which have been operated elsewhere, relatively small numbers were obtained of species belonging to such moth families as the Geometridae and Pyralidae, which normally are attracted to light in large numbers, except at Paliku where some night-flying rain forest-associated elements occurred. It appeared that, except for the Noctuidae, there was relatively little nocturnal flight activity in most of the areas sampled. This may have been a consequence of the relatively low night temperatures which prevail on Haleakala at elevations above 1800 m. Some species which belong to groups that are usually night fliers, appear to be primarily day fliers on Haleakala. For example, Eupithecia scoriodes (Meyrick), a geometrid moth endemic to Haleakala, was often taken while flying in daylight, but never taken in our light trap.

The endemic insect fauna of the Hawaiian Islands is characteristically disharmonic, with many of the major taxa very poorly represented or completely absent (Perkins, 1913; Zimmerman, 1948). The fauna endemic to the higher elevations of Haleakala is particularly depauperate as some elements which are better represented in endemic faunas of lower elevations (e.g., many of the endemic weevil genera; the orthopteroid families Gryllidae and Tettigoniidae) are virtually or completely absent in the higher and drier ecosystems of Haleakala. Some of the more successful groups which have been able to occupy these high altitude

areas include the planthoppers (Delphacidae) and mealybugs (Pseudococcidae), the seed bugs (Lygaeidae), plant bugs (Miridae), and the predaceous Nabidae, among the Hemiptera; the Hemerobiidae (Neuroptera); the Carabidae (Coleoptera); the Tephritidae (Diptera); certain elements of the Lepidoptera, particularly the Noctuidae but also some of the Geometridae, Pyralidae, Xylorictidae, and Cosmopterygidae; and the Aculeate Hymenoptera, represented by the Eumenidae (Odyneurus) and Sphecidae (Ectemnius) and the Hylaeidae (Nesoprosopis).

It is possible to make some further generalizations concerning the endemic arthropods of the high elevation ecosystems of Haleakala, based upon collections and associated ecological data obtained during the RBI survey, plus information derived from earlier collections and publications.

1) The non-native insect fauna (recent adventives) of Haleakala includes a number of temperate climate (Holarctic or Nearctic) species which do not occur in lowland areas of the state, although many are found at the higher elevations on other islands (e.g., the syrphid fly, Eristalis tenax (L.); the vespid wasp, Vespula vulgaris (L.); the brown lacewing, Hemerobius pacificus Banks; and the ensign scale, Arctorthezia occidentalis (Douglas), and several species of aphids.

2) Among the endemic phytophagous insects, particularly the Hemiptera, most groups exhibit a high degree of host specificity. Thus, among the mealybugs (Pseudococcidae), planthoppers (Delphacidae), plant bugs (Miridae), and seed bugs (Lygaeidae) most species appear to be restricted largely to one, or a few closely related species of native hosts. There are exceptions, such as the mealybug Pseudococcus nudus Ferris, which, although restricted in distribution to elevations above 1800 m, infests several unrelated native plants (i.e., Dubautia, Styphelia, and Vaccinium).

3) Many of the most precinctive endemics are flightless insect species which belong to groups that are usually capable of flight. For example, the flightless endemic ground beetle genus Mecyclothorax Sharp (Carabidae) attains its greatest diversity on East Maui with 36 described species on Haleakala (out of 86 known species), only one of which is known elsewhere (West Maui). Other unusual flightless elements of the Haleakala insect fauna include the xylorictid moth, Hodegia apatella Walsingham; the flightless lacewings (Hemerobiidae) Pseudospectra lobipennis Perkins, P. cookeorum Zimmerman, and Nesothauma haleakalae Perkins; a flightless dolichopodid fly, Campsicnemis haleakalaae Zimmerman; and a flightless reduviid bug, Saicella smithi Usinger. It should be pointed out that most of the genera mentioned contain other flightless species which occur elsewhere in Hawai'i.

4) There are many similarities between the high altitude endemic insect fauna of Haleakala and those of Mauna Loa, Mauna Kea, and Hualalai on Hawai'i. Many species are common to both islands. Other elements of the Haleakala fauna are represented on Hawai'i by closely related species which occur in similar environments (e.g., the large endemic Haleakala ground beetle, Barypristus rupicola [Blackburn] and its Hawai'i counterpart, B. incendarius [Blackburn]). However, there are some elements of the Haleakala fauna which appear to be unique to that mountain, and for which homologues apparently do not exist on Hawai'i; for example, the large day-flying geometrid moth Megalotica (Megalotica) holombra (Meyrick). The high altitude insect fauna of Haleakala seems to be slightly more diverse than that of Hawai'i, although this may be due, in part, to more thorough collecting.

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